

# Tertiary and Cretaceous brachiopods from Seymour, Cockburn and James Ross Islands, Antarctica

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## Synopsis

The systematics of the brachiopod fauna described by Buckman (1910) from the Lower Tertiary of Seymour and Cockburn Islands is revised. New species *Notosaria seymourensis*, *Terebratulina buckmani*, *Terebratella crofti* and *Liothyrella anderssoni* are described, as is the dallinoid 'Laqueus' *cockburnensis*, broadly assigned to that genus. Present views on the stratigraphical position and latest age estimates for the Lower Tertiary beds of Seymour Island are briefly discussed.

Descriptions of new genera and species *Protegulorhynchia meridionalis* (Hemithyrididae) and *Rossithyris huipensis* (Laqueidae), from the Upper Cretaceous, Campanian of James Ross Island, are given for the first time.

## Introduction

Andersson (1906) recognized two distinct lithologies within the Tertiary sequence on Seymour Island. One of these he described as a calcareous sandstone with tuff fragments, located chiefly in the Cross Valley area, while the remaining deposits were said to be friable sandstones with conglomerate intercalations. Plant remains were abundant in the calcareous sandstones and numerous invertebrate fossils, mainly brachiopods and molluscs, occurred in the more friable beds. The term Seymour Island Series was applied to the entire sequence.

Adie (1958 : 9) pointed out the existence of a major unconformity between the Tertiary and Cretaceous deposits which occur south-west from Cross Valley and also crop out at the most northerly point, Cape Wiman. Since this work, very few stratigraphical observations have been made on the island, but in 1974–75 an expedition, conducted by members of the Institute of Polar Studies at Ohio University, led to a publication by Elliot & Trautman (1979) who revised the Tertiary deposits and proposed the following formations.

*a. Cross Valley Formation*, for the sequence of non-marine sandstone and plant-bearing fine sandstone which crops out in Cross Valley and is regarded as of Palaeocene age.

*b. La Meseta Formation*, for the unconsolidated marine sands exposed on the flanks and to the north of the mesa situated on the north-eastern part of the island. The suggested age of the beds was late Eocene to early Oligocene, a view expressed also by Zinsmeister (1977) on the basis of faunal and floral evidence.

In the same paper, Zinsmeister (1977) points out that Wilkens' (1911) correlation of the 'Seymour Island Series' with the Patagonian Formation, though correct in chronological position, was wrongly dated as Oligocene–Miocene and should be regarded as older. He quoted the work of Comacho (1974; Comacho & Fernandez 1955), recording several species of *Venericardia planicosta* group bivalves from the lower part of the Patagonian Formation in central Patagonia. The presence of this cosmopolitan bivalve suggested to Comacho that the lower two-thirds of the formation was of Eocene age and that only the uppermost marine unit was of Oligocene age. Thus, according to Zinsmeister, the beds of the Seymour Island Series can be assigned an Eocene to Early Oligocene age with perhaps some of the Lower and Middle Eocene missing.

Other opinions vary with those of Cranwell (1959), who regarded the same deposits as Palaeocene, on the evidence of plant microfossils, and Simpson (1971), who assigned a late Eocene to

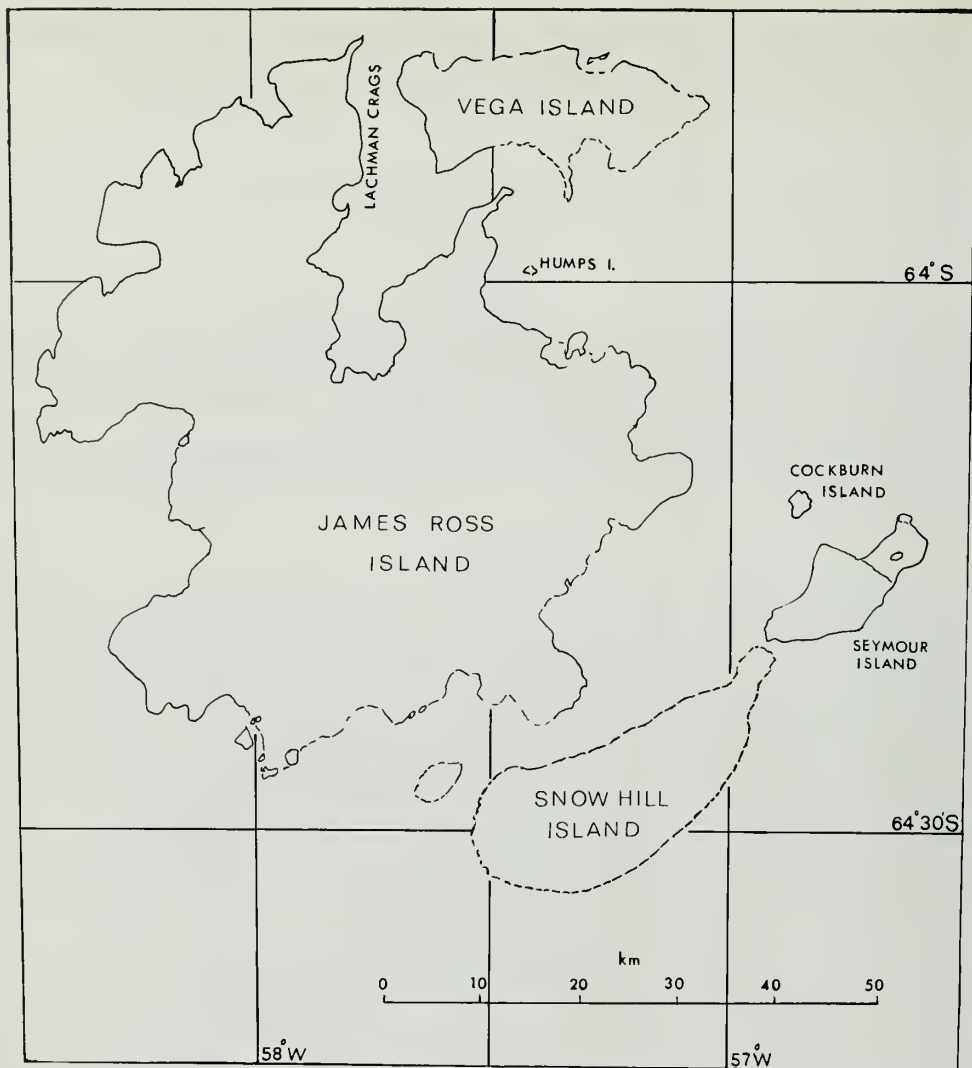


Fig. 1 Sketch map showing the relative positions of Seymour, Cockburn and James Ross Islands.

possibly early Oligocene age from the evidence of fossil penguin bones. Zinsmeister points out that Cranwell's data apply to the lower 110 m of the Seymour Island Series and that the upper 420 m contains a molluscan fauna which suggests an early Oligocene age.

Buckman (1910) interpreted the age of the beds on Seymour Island as Pliocene-Miocene on the evidence of a collection made by the Swedish explorer Dr J. Gunnar Andersson (1901-03) from one locality which Andersson called Loc. 11, and compared the brachiopods to Patagonian species. Those specimens from two further localities, Locs 12 and 13 on Cockburn Island, were ascribed a Miocene-Oligocene and a Pleistocene age, respectively, and compared to Australasian and South American species.

The brachiopods described here are from two collections, one made in 1947 by the late W. N. Croft from Seymour and Cockburn Islands, with additional Cretaceous material from James

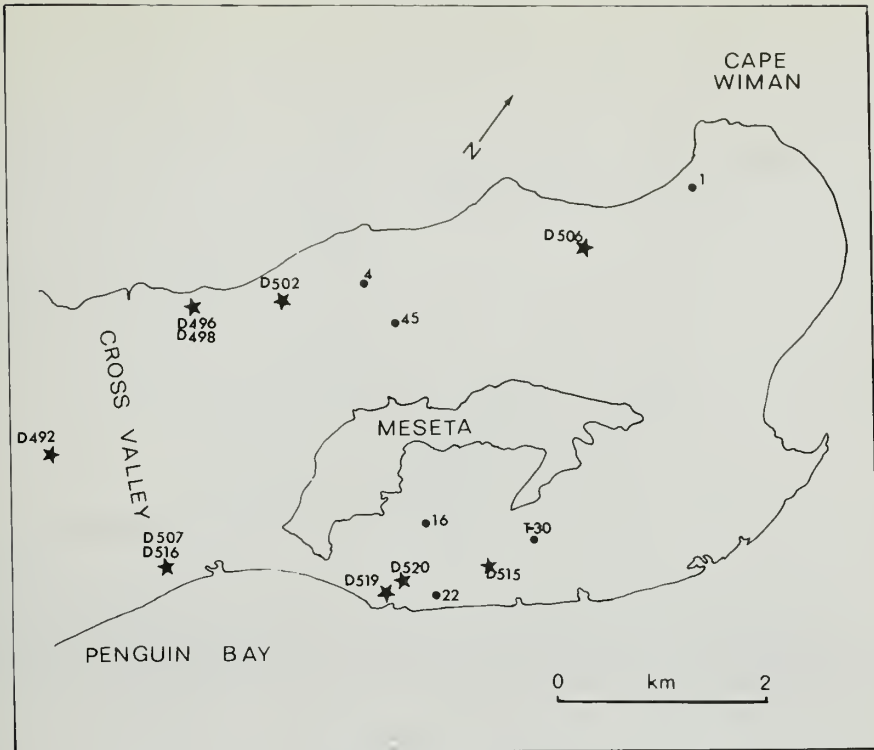


Fig. 2 Outline map of the northern sector of Seymour Island, showing the stations from which brachiopods have been collected. Prefix D indicates W. N. Croft's localities. Plain numerals are IPS localities.

Ross Island, and the other from a more recent visit to Seymour Island by D. H. Elliot and T. A. Trautman in 1974–75.

Unless otherwise stated, all material cited is preserved in the fossil brachiopod collections of the Department of Palaeontology, British Museum (Natural History); registered numbers are prefixed BB.

IPS refers to the Institute of Polar Studies, Ohio State University, U.S.A.

Using simple age and lithological terms, Croft divided the formations on Cockburn Island into the following groups.

1. Intrusive rocks of uncertain age
2. Pecten Conglomerate of Pliocene–Pleistocene age
3. Ross Island Formation
4. Tertiary beds with a brachiopod fauna
5. Cretaceous beds with ammonites

Croft stated in his original unpublished report (1947 : 3) that Andersson's locs 12 and 13 were visited and their positions corrected to points further north than those given on Anderson's sketch map, and on the west side of the island. It is clear from his notes that Croft was somewhat disorientated, since Andersson's sketch (1906 : 6) shows the localities situated on the south-eastern part of the island. Furthermore, Andersson (1906 : 41, fig. 3) gives a section through the beds on the 'East side of Cockburn Island at locality 12'.

Both the brachiopod fauna from Seymour Island and the fauna from the Tertiary beds of Cockburn Island are almost identical in constitution to those described by Buckman (1910),

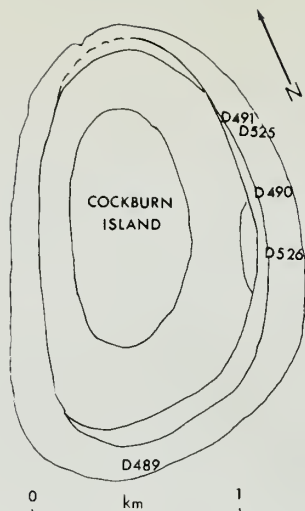


Fig. 3 Sketch map of Cockburn Island showing W. N. Croft localities.

which were based on material collected by Drs O. Nodenskjöld and J. Gunnar Andersson during the Swedish Antarctic Expedition of 1902–03. The present paper is, therefore, very largely a revision of Buckman's work, bringing the systematic and taxonomic aspects up to date.

### Systematic descriptions

Superfamily LINGULACEA Menke, 1828

Family LINGULIDAE Menke, 1828

Genus LINGULA Bruguière, 1797

*Lingula antarctica* S. S. Buckman

Fig. 10

1910 *Lingula antarctica* S. S. Buckman : 9; pl. 1, fig. 7.

Buckman described this species as an elongate, parallel-sided shell with rather flat valves, having growth-lines forming an oblong pattern throughout its life history. He figured a rather poorly preserved and incomplete specimen which he felt resembled *Glottidia palmeri* Davidson, but without any of the characteristic median ridges within the dorsal valve.

The specimen figured here, Fig. 10, is just 30 mm in length, about 5 mm longer than Buckman's figured specimen. It was collected by members of the expedition of 1974–75 mounted by the IPS (see p. 123) and comes from their loc. 16, approximately 1 km north of the eastern headland of Penguin Bay, Seymour Island. It is preserved in a highly glauconitic sandstone of Lower Tertiary age.

Buckman's specimen, which was collected from a point further eastward and nearer the coast, is from Loc. 11 of Nordenskjöld & Andersson, 1902–03, and mentioned by Buckman (1910 : 3) as having abundant *Bouchardia* specimens and '... crowded with examples of a small *Cerithium*', recently reidentified by Mr R. J. Clevely, British Museum (Natural History), as *Turritella* sp.

As Buckman pointed out (1910 : 34), the presence of a species of *Lingula* in beds of Tertiary age within the Antarctic is of interest since it extends the records of that genus to localities further south than Patagonia and the Australasian continent. With the additional material collected by the late W. N. Croft in 1947 and the single specimen figured here, from the collections

of the IPS, not only is its presence confirmed, but the new record lends weight to the argument for considerably increased climatic temperatures during Lower Tertiary times in this area, as living species of *Lingula* today prefer warmer climates and are seldom, if ever, found in other than tropical seas.

The presence of a high percentage of glauconite within the Tertiary beds of Seymour Island also suggests a somewhat shallow, high energy sea area, perhaps shelf or inshore conditions.

LOCALITY. IPS loc. 16 and loc. D.515 of W. N. Croft, said to be the fossil penguin locality and equivalent to loc. 11 of Andersson (1906).

HORIZON. Lower Tertiary.

MATERIAL. The figured specimen (IPS) and ten fragments, BB.76752-9.

Superfamily RHYNCHONELLACEA Gray, 1848

Family HEMITHYRIDIDAE Rzhonsnitskaya, 1956

Genus *HEMITHIRIS* d'Orbigny, 1847

*Hemithiris antarctica* S. S. Buckman

Figs 5a-c

1910 *Hemithiris antarctica* S. S. Buckman : 13; pl. 1, figs 8, 9.

The specimen figured here is one of three almost complete examples collected from the Glauconitic Bank on Cockburn Island. It departs from the original description and figured example of Buckman (1910 : pl. 1, figs 8, 9) in its broader trigonal general outline and in having very faint radial striae. The difference in outline can be explained in terms of variability within the species which is manifest in the few specimens available here, but Buckman referred to the absence of radial striae from the surface of *H. antarctica* and used this as a point of distinction between his species and *H. psittacea* (Gmelin) and *H. woodwardi* (Adams). Close examination under a low-power microscope of the specimens available shows them to have very faint radial striae on the shell surface of both valves. The produced beak, broad sulcus and large foramen appear to be characters common to all species of *Hemithiris*.

LOCALITY. W. N. Croft's locs D.491.4 and D.526, north-eastern section of Cockburn Island.

HORIZON. Lower Tertiary. Glauconitic Bank and Pecten Conglomerate.

MATERIAL. The figured specimen, two almost complete specimens and a small fragment from the Glauconitic Bank and two well-preserved specimens and a single pedicle valve from the Pecten Conglomerate, BB.76592, BB.76749-51, BB.76601-3.

Genus *NOTOSARIA* Cooper, 1959

*Notosaria seymourensis* sp. nov.

Fig. 4

DESCRIPTION. A single crushed rhynchonellide 18 mm long, 12 mm wide, broadly oval in general outline with surface ornament of 25 coarse, rounded, radiating costae interrupted by marked concentric growth-lines becoming more lamellose towards the shell margins. A short, suberect beak is truncated by a large, subcircular foramen guarded by slightly extended deltidial plates. A striated apical plate is just visible posteriorly. [The internal characters of this specimen were impossible to define owing to the crushing of the shell.]

NAME. From Seymour Island.

LOCALITY. W. N. Croft's loc. D.492.1, south-west of Cross Valley, Seymour Island. Croft's notes (1947 : 8) record this locality as yielding traces of plant remains in hard bands and a rhynchonellide which was collected from the top of knoll in the sandy clay beds.

HOLOTYPE. The specimen BB.76590 figured here, Fig. 4.

HORIZON. Lower Tertiary.

REMARKS. In his original description of the genus *Notosaria*, Cooper (1959 : 48) distinguished it from *Tegulorhynchia* Chapman & Crespin by its different costellae and fine growth-lines. The present specimen has comparatively coarse costae and rather marked concentric growth-lines. The nature of the growth-lines, though somewhat more marked than in the type species *N. nigricans* (G. B. Sowerby), appear to conform to the pattern illustrated by Cooper (1959 : pl. 6, figs 8, 9) and show the characteristic lamellose thickening at the margins.

The presence of a specimen of *Notosaria* within the Tertiary deposits of Antarctica extends the record southwards. The only other species so far recorded from the Tertiary of the southern hemisphere are *N. nigricans* (G. B. Sowerby) and *N. sublaevis* (Thomson) from the Miocene of New Zealand.

#### Genus *PLICIRHYNCHIA* Allan, 1947

##### *Plicirhynchia* sp.

1910 *Hemithyris plicigera* Ihering; Buckman : 12; pl. 1, fig. 10.

A single damaged pedicle valve and two crushed, but complete, specimens show generic characters of *Plicirhynchia*. The single valve is subtriangular in general outline, with a produced umbo and sharp beak. The shell surface of all three specimens is posteriorly striate with anterior costae developing marginal plicae. A marked growth-line occurs at about half the length of the shell and another nearer the margins, giving a somewhat lamellose appearance to the ornament.

The specimen figured by Buckman is not instantly recognizable as *Rhynchonella plicigera* Ihering to which he assigned it, but, in view of the poor original figure of the species by Ihering (1897 : 270, fig. 7) and the fact that Buckman's specimen was equally poor, it is not easy to draw any conclusion from the comparison. Cooper (1959 : 52) had similar doubts as to their direct specific relationship. When more material is available, it may be possible to compare the two forms more effectively.

LOCALITY. W. N. Croft's loc. 491.4, Cockburn Island.

HORIZON. Lower Tertiary. Glauconitic Bank.

MATERIAL. One pedicle valve and two crushed specimens referable to this genus, BB.76746, BB.76747, BB.76748.

#### Genus *TEGULORHYNCHIA* Chapman & Crespin, 1923

##### *Tegulorhynchia imbricata* (S. S. Buckman)

Figs 11a-c

1910 *Hemithyris imbricata* S. S. Buckman : 11; pl. 1, fig. 12.

EMENDED DESCRIPTION. *Tegulorhynchia* 12.9 mm long, 17 mm wide and 6.9 mm thick. Transversely oval in general outline. Umbo short, beak sharp; foramen small, circular. Beak-ridges distinct, interarea short. Brachial valve with a low incipient median fold. Pedicle valve with a broad shallow anterior sulcus. Anterior commissure arcuate; linguiform extension long. The shell surface consists of fine, rounded, radiating costellae interrupted by numerous concentric growth-lines, giving a lamellose or imbricate appearance. [Internal characters unknown owing to lack of suitable material.]

LOCALITY. W. N. Croft's loc. D.491.4, Cockburn Island.

HORIZON. Lower Tertiary. Glauconitic Bank.

MATERIAL. The specimen BB.76593 figured here, Fig. 11a-c, and one single pedicle valve, BB.76745, from the same horizon and locality.

REMARKS. The genus *Tegulorhynchia* is the subject of a forthcoming revision of the Tertiary Rhynchonellidae by Daphne Lee of Otago University, New Zealand. In her work she includes the species *T. squamosa* (Hutton) from the Oligocene of Broken River, Castle Hill Basin, New Zealand, and *T. imbricata* (Buckman). She concludes that the two species are probably synonymous. Topotype specimens of *Tegulorhynchia squamosa* (Hutton), kindly donated by Dr Lee, have been compared with specimens collected from Cockburn Island and identified as *T. imbricata*. Although the shell ornament is similar, in all other respects the two species have little in common. The general outline of *T. squamosa* is transversely triangular to subpentagonal, whereas that of *T. imbricata* remains transversely oval. Furthermore, *T. squamosa* appears to be more robust than *T. imbricata*, with a marked posterior inflation of the brachial valve. The umbo is slightly more produced in *T. squamosa* and consequently gives rise to a more extensive interarea bounded by well-marked beak-ridges.

Buckman's citation of a rhynchonellide specimen under the name of *Hemithyris squamosa* Hutton (Buckman 1910 : 10) and the accompanying figures (pl. 1, figs 13a, b) does not justify its assignment to *Tegulorhynchia squamosa* (Hutton) as originally described (Hutton 1873 : 37). It is probable that this specimen is merely a rather poorly preserved example of *T. imbricata*, but Buckman's figure does not show the typical ornament.

#### Genus *PROTEGULORHYNCHIA* nov.

TYPE SPECIES. *Protegulorhynchia meridionalis* sp. nov.

DIAGNOSIS. Subcircular to broadly oval costellate rhynchonellide. Fold low; anterior commissure arcuate. Linguiform extension long. Umbo small, slightly produced. Beak sharp, suberect. Beak-ridges distinct. Foramen small.

NAME. Allied to *Tegulorhynchia*.

#### *Protegulorhynchia meridionalis* gen. et sp. nov.

Figs 15a-c, 16

DESCRIPTION. Small rhynchonellide, 18 mm long, 15 mm wide and 5.6 mm thick. Ornament of 32-35 fine, rounded costellae, with 8-10 on low dorsal fold and a corresponding number in shallow ventral sulcus in the anterior part of the pedicle valve. Marked concentric growth-lines become more lamellose anteriorly and thicken at the shell margins. [Internal characters unknown owing to lack of material.]

NAME. 'Southern'.

HOLOTYPE. The specimen BB.76770 figured here as Figs 15a-c.

LOCALITY. W. N. Croft's loc. D.533. On the saddle between the two peaks on Humps Islet, 63°59' S, 57°25' W, James Ross Island.

HORIZON. Upper Cretaceous. Lower Campanian.

MATERIAL. The holotype, BB.76770 and two other fragmentary specimens, BB.76771, BB.76772.

REMARKS. The arrangement of costellae and the lamellose nature of the concentric growth-lines are suggestive of a relationship with *Tegulorhynchia* from Tertiary and Recent localities. Similar shell ornament, however, occurs in *Rhynchonella crenifera* which was described by Stoliczka (1872-73) from the Arrialoor Groop (Campanian) of the Upper Cretaceous of Mulloor, southern India (pl. 1, figs 9 & 10 only). *Protegulorhynchia meridionalis* differs from this species in its more circular general outline and shorter or less produced umbo. Nevertheless, it is felt that the two forms are closely related and *Rhynchonella crenifera* Stoliczka is therefore here assigned, albeit tentatively, to the genus *Protegulorhynchia*, largely on similarity of general morphology and ornament.

Family CANCELLOTHYRIDIDAE Thomson, 1926  
 Subfamily CANCELLOTHYRIDINAE Thomson, 1926  
 Genus *TEREBRATULINA* d'Orbigny, 1847

*Terebratulina buckmani* sp. nov.

Fig. 9

1910 *Terebratulina lenticularis* Tate; Buckman : 28, pl. 3, fig. 4.

DESCRIPTION. *Terebratulina* 24.9 mm long, 20 mm wide and approximately 18 mm thick. Broadly oval in general outline, greatest width just anterior to mid-line. Slightly produced umbo truncated by large circular, submesothyridid, attrite foramen. Deltidial plates obscured by slightly inflated posterior part of dorsal umbo. Beak-ridges distinct; interarea moderately well defined, fairly extensive. A faint sulcus is just discernible in the anterior part of the ventral valve. The anterior commissure is incipiently uniplicate.

NAME. For S. S. Buckman.

LOCALITY. W. N. Croft's loc. D.491.5, Cockburn Island.

HOLOTYPE. The specimen BB.76594 figured here, Fig. 9.

HORIZON. Lower Tertiary. Glauconitic Bank.

REMARKS. Buckman figured a uniformly oval specimen (1910 : pl. 3, fig. 4) from the Glauconitic Bank of Cockburn Island with a maximum width about midway between the umbo and

Fig. 4 *Notosaria seymourensis* sp. nov. **Holotype**, BB.76590, Lower Tertiary, SW of Cross Valley, Seymour Island.  $\times 1.5$ .

Figs 5a-c *Hemithiris antarctica* S. S. Buckman. BB.76592, Lower Tertiary, Glauconitic Bank, northeastern section, Cockburn Island.  $\times 1.5$ .

Figs 6a-c *Liothyrella lecta* (Guppy). BB.76591, Lower Tertiary, northeastern section, Cockburn Island.  $\times 1.5$ .

Figs 7a-c '*Terebratella*' sp. BB.76784, Lower Campanian, Lachman Crags South, James Ross Island.  $\times 1.5$ .

Fig. 8 '*Laqueus*' *cockburnensis* sp. nov. **Holotype**, BB.76595, Lower Tertiary, Glauconitic Bank, Cockburn Island.  $\times 1.5$ .

Fig. 9 *Terebratulina buckmani* sp. nov. **Holotype**, BB.76594, Lower Tertiary, Glauconitic Bank, Cockburn Island.  $\times 1.5$ .

Fig. 10 *Lingula antarctica* S. S. Buckman. Lower Tertiary of IPS loc. 16, Seymour Island.  $\times 1.5$ .

Figs 11a-c *Tegulorhynchia imbricata* (S. S. Buckman). BB.76593, Lower Tertiary, Glauconitic Bank, Cockburn Island.  $\times 1.5$ .

Figs 12a-c *Magella australis* (S. S. Buckman). BB.76615, Lower Tertiary, Glauconitic Bank, Cockburn Island.  $\times 1.5$ .

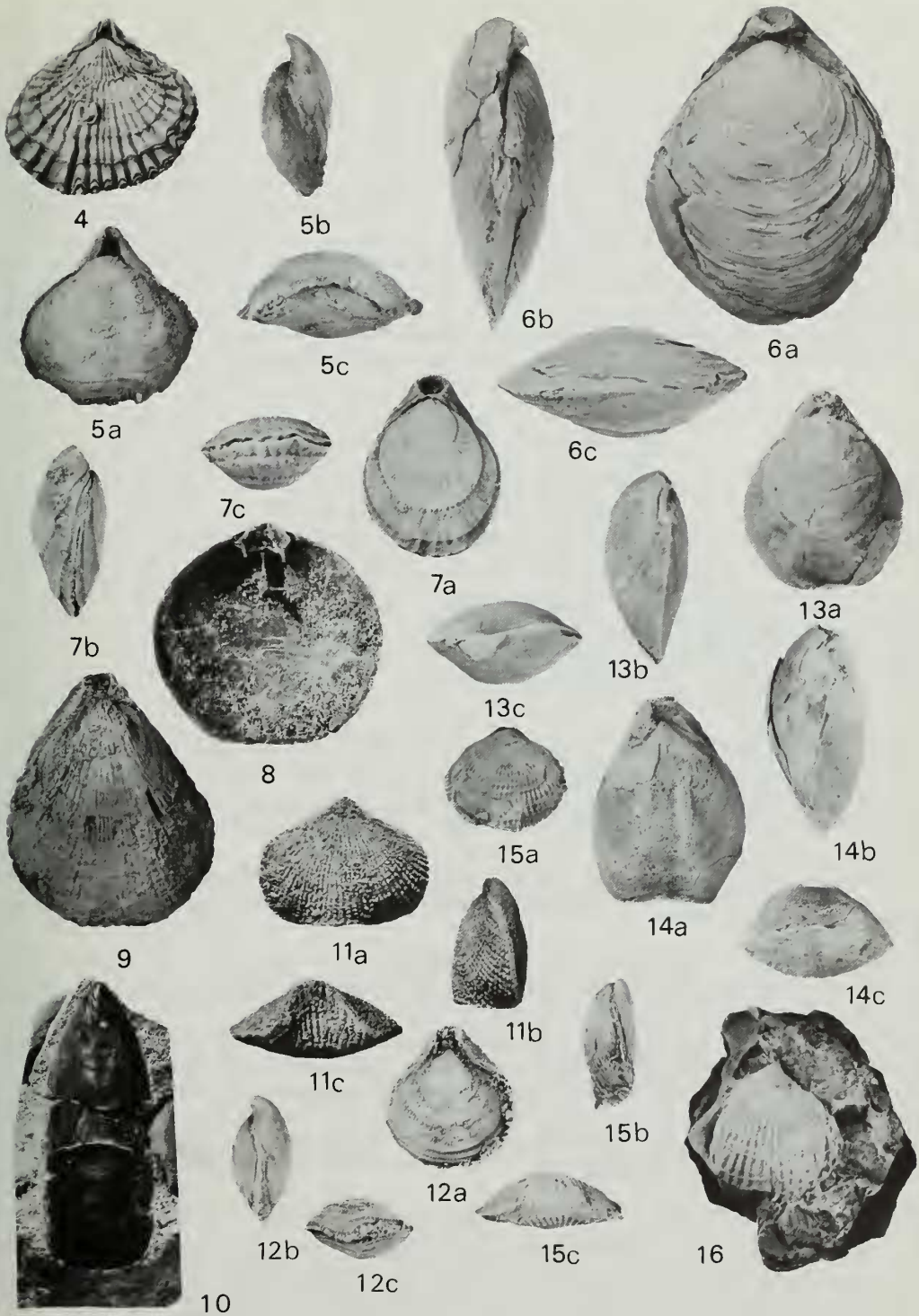
Figs 13a-c '*Terebratula*' sp. BB.76788, Upper Cretaceous, Lower Campanian, Lachman Crags South, James Ross Island.  $\times 1.5$ .

Figs 14a-c *Terebratulina* sp. BB.76789, Lower Campanian, Humps Islet, James Ross Island.  $\times 1.5$ .

Figs 15a-c, 16 *Protegulorhynchia meridionalis* gen. et sp. nov. Figs 15a-c, **Holotype**, BB.76770. Fig. 16, BB.76771. Both Lower Campanian, Humps Islet.  $\times 1.5$ .

a—Dorsal view. b—Lateral view. c—Anterior view.





anterior commissure. In assigning the specimen to Tate's *Terebratulina lenticularis*, which was originally described from the Miocene of Aldinga, South Australia, Buckman pointed out certain discrepancies between the two forms which amounted to a difference in overall outline, beak features and sulcation of the ventral valve. He considered that the more circular outline and considerably smaller dimensions of Tate's specimens were because of their younger individual age. Comparison of the specimen figured here as *Terebratulina buckmani* sp. nov. has been made with a series of specimens in the British Museum (Natural History), which were collected and identified by R. Tate and sent to T. Davidson. The largest of nine individuals was only 8.5 mm in length. All the specimens showed less extensive interareas, and the shell ornament of fine imbricate costellae was given to more frequent bifurcation than in our Antarctic specimen.

It must be admitted that, even with careful reconstruction, the present crushed specimen could never assume the uniform outline shown in Buckman's drawing (1910: pl. 3, fig. 4). It is possible that such differences in outline would be within the normal limits of variability of *T. buckmani* and, since neither form can be positively assigned to any other described species of *Terebratulina* within the Tertiary, it is felt that a new taxon is justifiable.

Family **TEREBRATELLIDAE** King, 1850

Subfamily **BOUCHARDIINAE** Allan, 1940

Genus **BOUCHARDIA** Davidson, 1850

*Bouchardia antarctica* S. S. Buckman

Figs 19a-c, 20a-b, 21a-c, 22a-b, 23, 24, 25, 26a-b

1910 *Bouchardia antarctica* S. S. Buckman : 16; pl. 1, figs 2, 3.

1910 *Bouchardia ovalis* S. S. Buckman : 16; pl. 1, fig. 1.

1910 *Bouchardia angusta* S. S. Buckman : 16; pl. 1, fig. 4; pl. 3, fig. 2.

1910 *Bouchardia elliptica* S. S. Buckman : 17; pl. 1, fig. 5.

1910 *Bouchardia attenuata* S. S. Buckman : 17; pl. 1, fig. 6.

**EMENDED DESCRIPTION.** *Bouchardia* approximately 23.8 mm long, 15.2 mm wide and 9.9 mm thick. Elongate-oval in general outline. Test thick, smooth, punctate. The umbo is short and massive with an obtuse beak dominated by a moderate to large, circular, epithyridid foramen. Extensive interarea bounded by sharp beak-ridges. The slightly concave symphytium is well exposed.

Eight to ten marked concentric growth-lines feature prominently on the almost equally convex valves. A strong carination of the pedicle valve persists anteriorly giving rise to an acute carinate anterior commissure.

*Internal structures.* The umbonal cavity of the pedicle valve is reduced in size by the lateral thickening of the shell and the swollen bases of the elongate hinge-teeth. A low septal ridge extends the length of the valve.

Within the brachial valve the cardinalia are thickened and fused. The area normally occupied by the hinge-trough in other Terebratellidae is filled with the thickened crural bases to form a hinge-platform. The premagadiniiform brachial loop is supported by a strong, high, median septum.

**LOCALITIES.** W. N. Croft's locs D.498, D.504, D.506, D.507, D.515, D.519 and those of the IPS T-30, 22, 4.49; all from Seymour Island.

**HORIZON.** Lower Tertiary.

**MATERIAL.** 122 specimens, BB.76596-98, BB.76620-743, and 77 specimens in the IPS.

**REMARKS.** Buckman described five species of *Bouchardia* from the Younger Beds of the Tertiary deposits on Seymour Island. He distinguished them chiefly on grounds of overall general outline, some appearing more oval or elliptical and others with less acute carination of the pedicle valve.

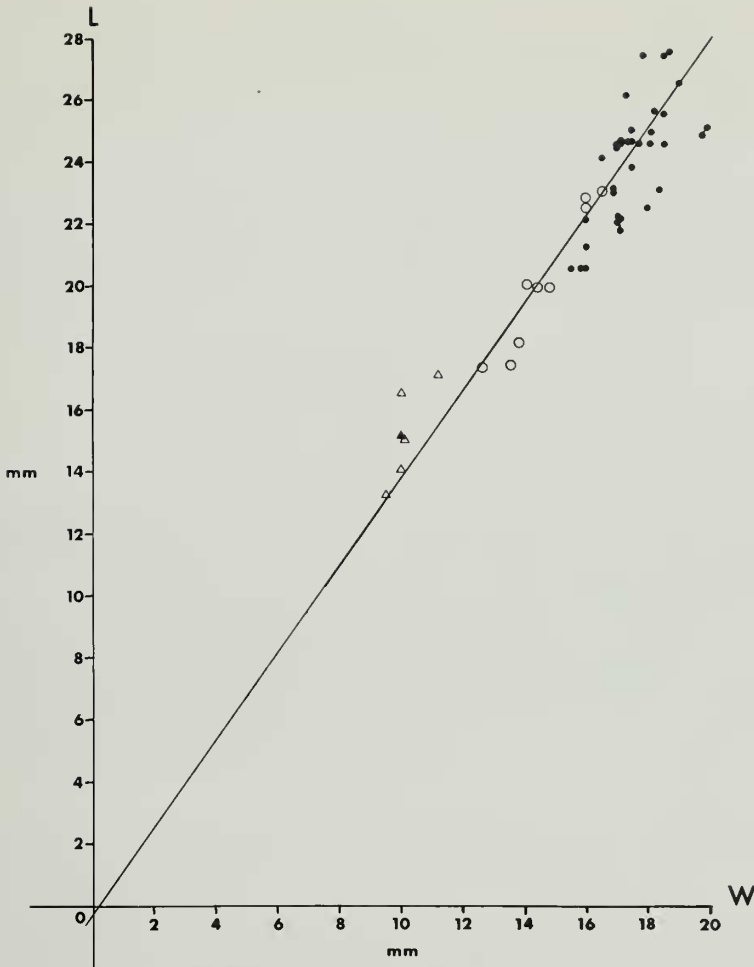


Fig. 17 Scatter diagram showing relationship of length to width in specimens of *Bouchardia antarctica* S. S. Buckman; same material as in Fig. 18. ● - IPS loc. T-30. ▲ - IPS locs 4, 22, 45. ○ - W. N. Croft locs.

All the specimens examined by him were collected from localities within the same geological horizons specified at that time. There is little to be said in favour of such narrow taxonomic splitting as Buckman effected, and it is more likely that, within the entire assemblage occurring in the Tertiary rocks on Seymour Island, no more than two actual species exist. Variants assigned to the species *Bouchardia ovalis*, *B. elliptica*, *B. attenuata* and *B. angusta* can be recognized in random samples from the same horizon and localities as those of the dominant species *B. antarctica*. The variation in form seems to be affected principally by the breadth of the valves or the extent of the hinge-line, those individuals with narrower or less extensive hinge-lines appearing somewhat more oval in outline.

Samples containing a mixture of specimens previously identified as *B. antarctica*, *B. ovalis*, *B. elliptica*, *B. attenuata* and *B. angusta*, together with samples of both large and small unidentified specimens collected from Seymour Island by members of the IPS expedition of 1974-75, have been measured. Taking straightforward parameters of length, width and thickness of the valves, the measurements have been plotted and are figured here as scatter diagrams, Figs 17 and 18.

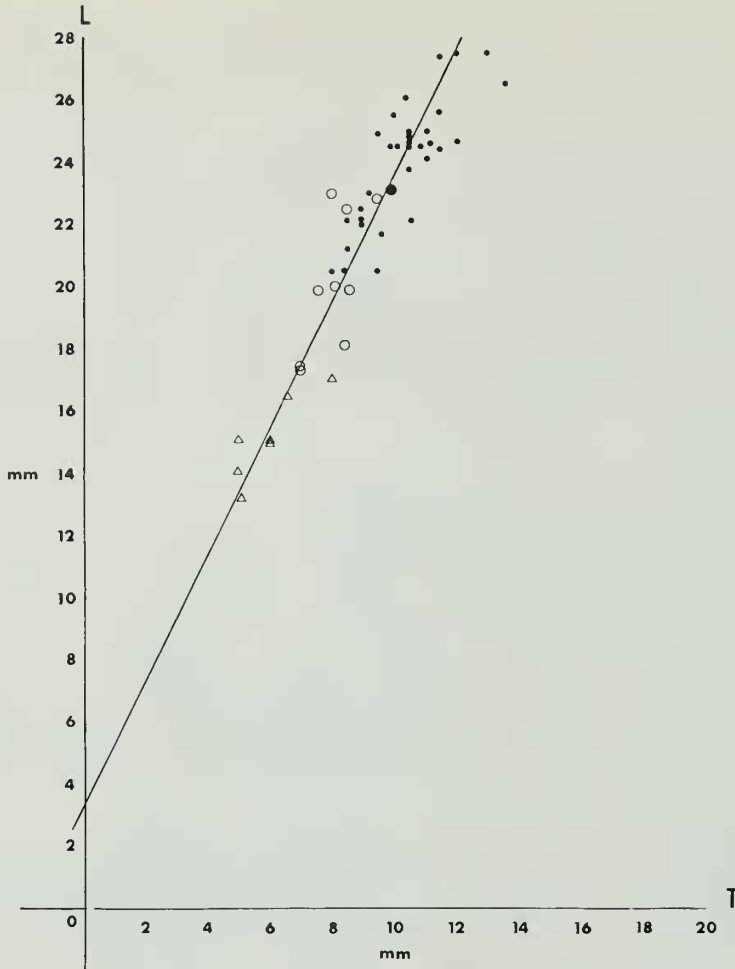


Fig. 18 Scatter diagram showing relationship of length to thickness in specimens of *Bouchardia antarctica* S. S. Buckman; same material and symbols as in Fig. 17.

The scatter diagrams clearly indicate a single species for the five taxa erected by Buckman (1910) and for the species represented by specimens collected by the IPS. These forms are here assigned to *Bouchardia antarctica* S. S. Buckman.

Ihering (1897 : 268) described *Bouchardia zitteli* from the Tertiary of Patagonia. He figured a specimen (1897 : fig. 6) which, although similar in general outline to *B. antarctica* Buckman, differs in having fewer and more pronounced concentric growth-lines and also in its faint carination of the anterior part of the dorsal valve. *B. zitteli* was again cited by Ihering (1903 : 334) and a specimen figured (1903 : pl. 3, fig. 9), together with a specimen of *Bouchardia patagonica* (1903 : pl. 3, fig. 10) which he had described from the Palaeocene of St Jorge Gulf, Pico, Salamanca, Chile. An error in the numbering of the specimens figured on the plate has caused confusion over the identification of these species. The numbers have in fact been transposed. Levy (1964 : 213) drew attention to this error when describing specimens of *B. patagonica* from the type locality.

In the same publication Levy (1964) also described and figured examples of *Bouchardia zitteli* Ihering (unfortunately misspelled as *B. zittelli*) from the Lower Tertiary of Santa Cruz, Argentina. She figured four examples (1964 : pl. 1, figs 3, 4) showing a fair range of variation in outline

from broadly elongate-oval to subpentagonal in form. On the same plate (pl. 1, figs 5a-d) she figured examples of *B. transplatina* from the Miocene of the Buenos Aires area which she compared to *B. antarctica* Buckman, pointing out the difference in the carination of the ventral valve which, in *B. transplatina* Ihering, appears to be more acute than in Buckman's species. She figured a damaged specimen (figs 5a-c) with a strong carination of the pedicle valve and a corresponding sulcus in the anterior part of the brachial or dorsal valve.

Thomson (1918 : 260) had considered *B. angusta* Buckman and *B. transplatina* Ihering to be indistinguishable. As previously stated, *B. angusta* and *B. antarctica* are merely variants within the same species. It may be proved, at some future date, that *B. antarctica* Buckman and *B. transplatina* Ihering are synonyms. No examples of *B. transplatina* were available for comparative study when the present publication was being prepared and, therefore, no confirmation of Thomson's ideas was possible.

Subfamily TEREBRATELLINAE King, 1850

Genus TEREBRATELLA d'Orbigny, 1847

*Terebratella crofti* sp. nov.

Figs 27a-c

DESCRIPTION. Medium-sized biconvex pentagonal terebratellide approximately 27.7 mm long, 24.9 mm wide and 13 mm thick. Dorsal valve with moderate umbonal convexity. Median sulcus originating from about the middle of the dorsal valve and broadening anteriorly. A median septum can be seen extending from the posterior umbo to just over half the length of the dorsal valve. Concentric growth-lines appear irregularly spaced but are well defined.

The ventral valve is acutely carinate with a broad hinge-line and massive umbo truncated by a large circular, mesothyridid foramen. Beak-ridges are distinct and define an extensive, smooth interarea. Anterior commissure sulcate. Faint radiating costellae are just visible on the shell surface, becoming stronger anteriorly.

NAME. For W. N. Croft.

LOCALITY. IPS coll. loc. 4, north Seymour Island.

HOLOTYPE. The specimen figured here, Figs 27a-c. IPS, Ohio State University, U.S.A.

HORIZON. Lower Tertiary.

REMARKS. The figured specimen bears a superficial resemblance to a specimen described by Buckman (1910 : pl. 1, fig. 17a-d) as *Magasella antarctica* from the Glauconitic Bank of Cockburn Island. It differs from that species in its greater dimensions, more acutely pentagonal general outline, wider hinge-line and less acutely inflated dorsal umbo. It is somewhat similar, however, to the specimen described and figured by Ortmann (1902 : 78; pl. 14, fig. 2a, b) as *Terebratella gigantea* from the Cape Fairweather Beds, Cape Fairweather, Patagonia. Ortmann's specimen is considerably larger and has a less pentangulate outline.

Levy (1961 : 87; pl. 3, fig. 1a-c) described and figured a similar form from the Lower Tertiary of Patagonia as *Pachymagas gigantea* (Ortmann), following the assignment of that species by Thomson (1927 : 286) to the genus *Pachymagas*. Levy's specimen, however, does not appear to have many of the characters associated with *Pachymagas*, such as hinge teeth with swollen bases, a produced umbo and an extensive interarea. Instead it resembles many specimens hitherto assigned to *Magellania venosa* (Solander). Nevertheless, it does bear a resemblance to the specimen described and figured here as *Terebratella crofti* sp. nov.

'*Terebratella*' sp.

Figs 7a-c

DESCRIPTION. Elongate-oval terebratellide 19 mm long, 14.3 mm wide and 18.1 mm thick. Shell biconvex, ornamented by 25-30 strong, rounded radiating costae, given to frequent bifurcation and interrupted by marked, step-like concentric growth-lines. The short, massive umbo of

the pedicle valve is truncated by a large, circular foramen. The beak-ridges are indistinct and the interarea is poorly defined. The anterior commissure is incipiently uniplicate.

LOCALITY. W. N. Croft's loc. D.422.2, Lachman Crags South, James Ross Island.

HORIZON. Upper Cretaceous. Campanian.

MATERIAL. The single specimen BB.76784 figured here, Fig. 7a-c.

REMARKS. Although tentatively assigned to '*Terebratella*' sp., the specimen is of a distinctly *Magellania* aspect. It does not have a median fold in the brachial valve, nor does it develop a sulcus in the pedicle valve, two features which distinguish it from other costate species assigned to *Magellania*. A faint septum, extending to about half the length of the shell, is just visible in the brachial valve. Owing to the rather poor state of preservation of the specimen, there is no clear indication of the development of dental lamellae in the pedicle umbo.

The specimen was found in beds of supposedly Campanian age and from a locality recorded by Spath (1953 : 58) as both C.41370 and C.41377, from which the ammonite *Gunnarites kalika* (Stoliczka) was also recorded.

Genus *MAGELLANIA* Bayle, 1880

*Magellania antarctica* (S. S. Buckman)

Figs 30a-c, 31

1910 *Pachymagas antarcticus* S. S. Buckman : 21; pl. 2, figs 5-7.

EMENDED DESCRIPTION. Elongate-oval *Magellania*, approximately 54 mm long, 37 mm wide and 26 mm thick. Umbo massive, suberect, truncated by large, subcircular, mesothyridid foramen; beak-ridges attrite, fairly prominent, interarea extensive. Large conjunct deltidial plates form broad, subquadrate symphytium. Shell surface smooth with numerous fine concentric growth-lines. Anterior commissure incipiently sulcate.

Pedicle valve more acutely convex than the brachial valve and with a degree of carination posteriorly. A low median fold is developed at about midway between the pedicle umbo and the anterior commissure.

LOCALITY. W. N. Croft's locs D.491.4, Glauconitic Bank, Cockburn Island, and D.519.3, 45 m SW of headland of Penguin Bay, Seymour Island.

HORIZON. Lower Tertiary.

MATERIAL. Two damaged specimens, one almost complete, but with damaged anterior, BB.76599, and one single pedicle valve, BB.76744, showing massive, peg-like hinge teeth.

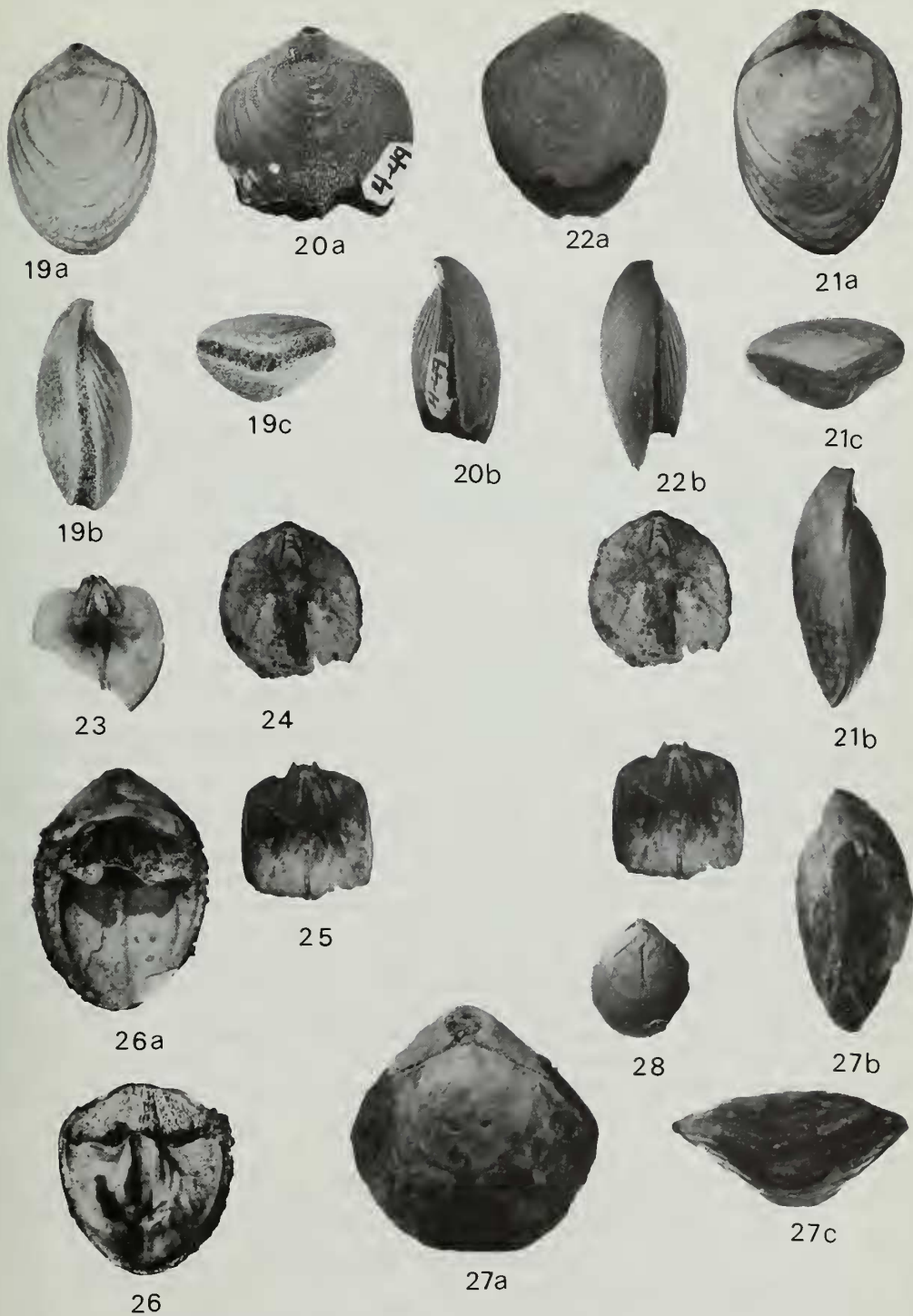
REMARKS. Although unlike other Tertiary species of *Magellania* previously described, *M. antarctica* is nevertheless comparable in size and general outline to *Magellania patagonica* (Sowerby)

Figs 19-26 *Bouchardia antarctica* S. S. Buckman. All  $\times 1.5$ . Figs 19a-c, BB.76596, Lower Tertiary, Seymour Island. Figs 20a-b, 22a-b, IPS coll. 4.49, Figs 20a-b showing the atypical wide hinge-line, somewhat similar to *B. zitteli* Ihering. Figs 21a-c, IPS coll. T-30, showing slightly more parallel sides to the valves. Fig. 23, interior of brachial valve from IPS coll. T-30, showing the cardinalia and brachidium. Figs 24, stereo pair showing brachial valve with cardinalia and brachidium as internal moulds; BB.76597, Lower Tertiary of Seymour Island. Figs 25, stereo pair of a brachial valve showing cardinalia and brachidium; the hinge-line is more quadrate in outline than in the previous specimen. Lower Tertiary, Seymour Island. Figs 26a-b, a large specimen from IPS T-30, cleaned of matrix to show the massive brachial platform and strong median septum supporting the thickened brachial loop.

Figs 27a-c *Terebratella crofti* sp. nov. **Holotype**, IPS coll. loc. 4, Seymour Island.  $\times 1.5$ .

Fig. 28 *Rossithyrus humpensis* gen. et sp. nov. **Holotype**, BB.76773, Upper Cretaceous, Lower Campanian, Humps Islet.  $\times 1.5$ .

a—Dorsal view. b—Lateral view. c—Anterior view.



from the Miocene of Patagonia. It differs from this species, however, in its less acute inflation of the brachial umbo and in the incipient sulcation of the anterior commissure.

Buckman (1910) figured three specimens under the name of *Pachymagas antarcticus*. One of these figures (1910 : pl. 2, fig. 3) is said to be greatly restored. There was enough of the specimen left to remind Buckman of the species described by Ihering (1903) as *Pachymagas venter* from the Lower Patagonian of Patagonia. Buckman also pointed out that there was a similarity in form between his species and that of *Magellania venosa* as figured by Davidson (1886-88 : pl. 14, fig. 2). It is very largely on the strength of this remark and not so much on the rather poor reconstruction of Buckman's figured specimen (1910 : pl. 2, fig. 5a-c) that the specimens described and figured here as *Magellania antarctica* (Buckman) are assigned to that genus and species.

Genus *MAGELLA* Thomson, 1915

*Magella australis* (S. S. Buckman)

Figs 12a-c

1910 *Magasella australis* S. S. Buckman : 19; pl. 1, figs 14-16; pl. 3, fig. 3a-b.

EMENDED DESCRIPTION. Subquadrate to oval biconvex *Magella*, 9.7 mm long, 9 mm wide and 5.1 mm thick. Test thin, smooth, with irregularly-spaced but well-defined concentric growth-lines. Pedicle umbo massive with suberect beak dominated by large incomplete submesothyridid foramen, guarded by short discrete deltidial plates.

Brachial valve with slightly inflated umbo. A shallow sulcus develops anteriorly and gives rise to a sulcate anterior commissure.

*Internal characters.* Long, high median septum in the brachial valve supports a strong magelliform brachial loop.

LOCALITY. W. N. Croft's locs D. 491.4 and D.526, Cockburn Island.

HORIZON. Lower Tertiary. Glauconitic Bank and Pecten Conglomerate.

MATERIAL. Eight specimens from the Glauconitic Bank, BB.76615-22, and two from the Pecten Conglomerate BB.76623-4.

REMARKS. In his original description of the species Buckman (1910 : 19) refers to the anterior commissure as being '... folded to an M-Shape.' In fact, the specimen he figured (1910 : pl. 1, fig. 14c) is shown with the ventral valve uppermost which, by present-day standards, would be upside down. Thus, his description of M-shaped anterior commissure should be interpreted as w-shaped. Even so, the term does not fit the specimen figured by Buckman, nor can any specimen recently examined for the present study be described as having such a commissure.

The eight specimens examined here show a range from near rectimarginate to having a faintly sulcate anterior commissure, the sulcation developing late in the development of the shell and, therefore, being more apparent in the more mature specimens.

Thomson (1915 : 396), in his description of the genus *Magella*, suggested that *Magasella gouldi*, which Dall (1870) had described from recent seas of Japan, was based on the young stages of another terebratellid, possibly a species of *Magellania*, and, on this account, referred Buckman's species *Magasella australis* to *Magella*.

Family LAQUEIDAE Thomson, 1927

Subfamily LAQUEINAE Thomson, 1927

Genus *ROSSITHYRIS* nov.

TYPE SPECIES. *Rossithyrus humpensis* sp. nov.

DIAGNOSIS. Small, oval, evenly biconvex laqueinid. Umbo short, foramen small, permesothyridid.



Test smooth, evenly punctate. Commissure plane. Dental lamellae short. Brachial loop laqueiform.

NAME. From James Ross Island.

*Rossithyris humpensis* sp. nov.

Fig. 28

DESCRIPTION. The shell is approximately 11.6 mm long, 9.8 mm wide and 5 mm thick. Although evenly biconvex, there is a slight inflation of the umbonal region of each valve. A well-marked median septum extends just over half the length of the brachial valve. Numerous very faint concentric growth-lines appear at irregular intervals on the shell surface.

*Internal characters.* Pedicle valve with short subparallel dental lamellae supporting thick, inwardly-directed, peg-like hinge-teeth.

Brachial valve with a comparatively narrow, v-shaped, steep-sided hinge-trough with well-developed inner and outer socket ridges broadening anteriorly and supported by a strong, high median septum. Elongate triangular hinge-plates give rise to the descending branches of the brachial loop which quickly develop inwardly-curving crural processes.

The broad transverse band of the ascending branches, which forms the simple laqueiform hood, appears, in transverse serial sections, at an earlier stage in *Rossithyris* than in either the Recent *Laqueus* or *Waconella* from the Cretaceous, and develops anteriorly. The descending branches connect with the median septum by means of long, thin, lateral connecting bands, Fig. 29. Similar bands are seen in transverse serial sections of *Laqueus californicus* (Koch) and *Waconella wacoensis* (Roemer) (Owen 1970 : 76-77).

NAME. From Humps Islet.

LOCALITY. W. N. Croft's loc. D.533.2 and recorded by Spath (1953 : 60) as 'on the saddle between the two peaks on Humps Islet, lat. 63°59'S; long. 57°25'W.'

HOLOTYPE. The specimen BB.76773 figured here as Fig. 28.

HORIZON. Upper Cretaceous, probably Lower Campanian. The fauna is associated with *Gunnarites antarcticus* (Weller) and *Tetragonites* sp., both ammonites previously described from localities of Campanian age within the Antarctic (Spath 1953 : 29, Howarth 1958 : 10).

MATERIAL. The holotype, BB.76773 and four fragmentary specimens, BB.76774-7.

REMARKS. Although only five specimens of this species have been collected so far, they represent a form hitherto undescribed and closely related to the Recent genus *Laqueus*. *Rossithyris humpensis* differs from that genus in that it is considerably smaller and in minor differences of brachial loop development, having a less complex but fundamentally similar expansion of the transverse band of the ascending branches. In *Laqueus* this band develops a more expansive hood with lateral lacunae. The attachment of the descending branches to the median septum occurs at an earlier stage than in any previously-described member of the Laqueinae and, in this respect, *Rossithyris* is similar to a species described below as '*Laqueus*' *cockburnensis*.

Genus *LAQUEUS* Dall, 1870

'*Laqueus*' *cockburnensis* sp. nov.

Fig. 8

DESCRIPTION. Brachial valve 22.4 mm long, 23.1 mm wide. Subpentagonal to elongate-oval in outline. Test thin, smooth with numerous faint concentric growth lines on external surface. A faint median sulcus is developed late in the anterior portion of the brachial valve. No cardinal process seen. Subquadrate hinge-trough, with well-developed inner and outer socket ridges, is supported by a strong, high median septum which extends to about one-third the length of the valve. The descending branches of the brachial loop are given off from the anterior part of the hinge-trough and quickly develop long, inwardly curving crural processes. A thin straight band

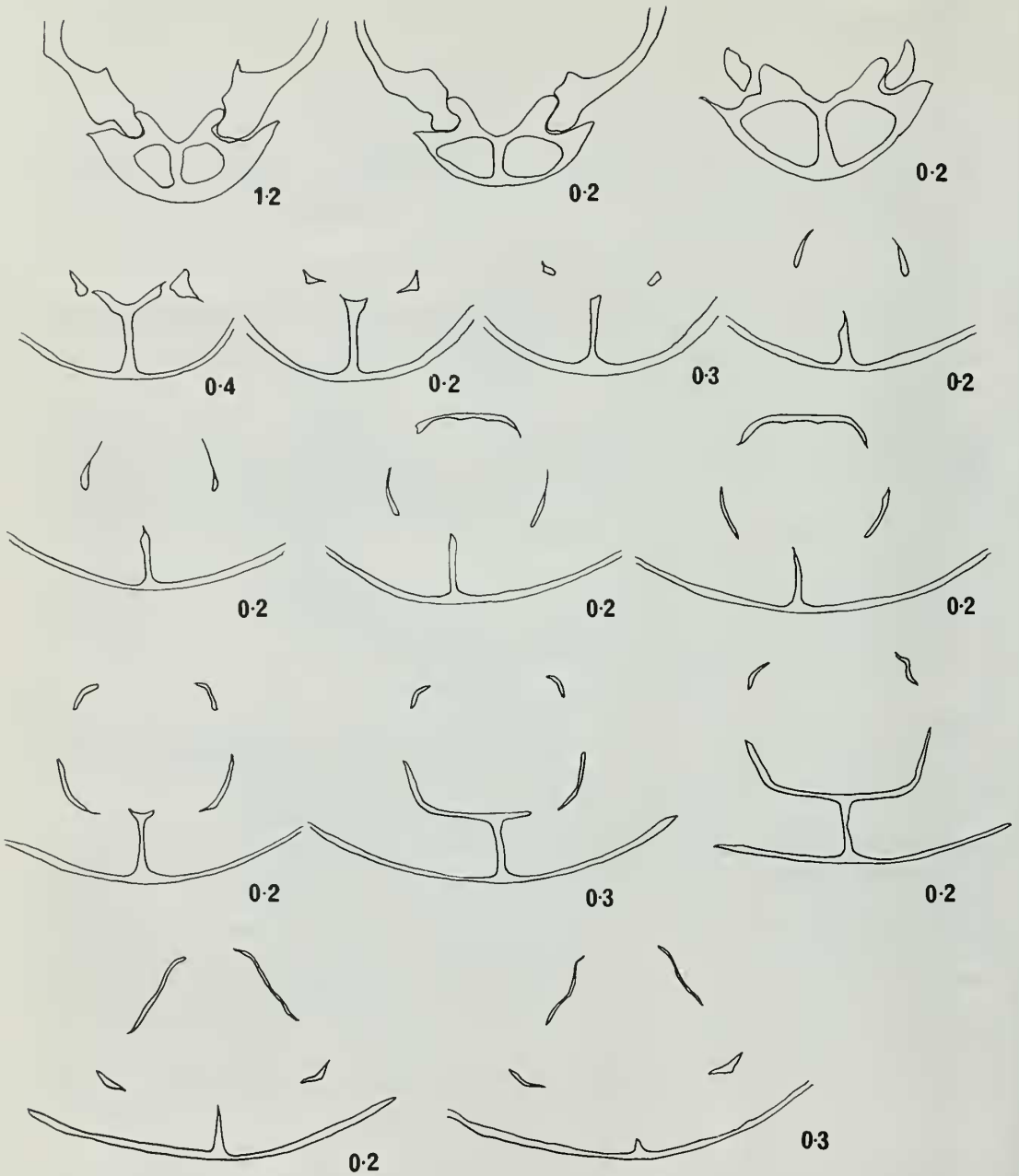


Fig. 29 Fifteen transverse serial sections through the umbo of a specimen of *Rossithyris humpensis* gen. et sp. nov., Lower Campanian, Humps Islet.  $\times 4$ .

of attachment between the descending branches of the brachial loop and the median septum develops at an earlier stage than is found in the Recent species *Laqueus californicus* (Koch). It is noted, however, that in specimens of *Laqueus vancouveriensis* (Davidson) from the waters of Naha Bay, south-eastern Alaska, an earlier attachment of loop to septum occurs and that this stage is accompanied by a less expansive or simpler development of the transverse band or laqueiform hood in the ascending branches.

NAME. From Cockburn Island.

LOCALITY. W. N. Croft loc. D.491, Cockburn Island.

HOLOTYPE. The specimen BB.76595 figured here, Fig. 8.

HORIZON. Lower Tertiary. Glauconitic Bank.

MATERIAL. Two brachial valves and three fragmentary pedicles valves, BB.76595, BB.76785, BB.76786, BB.76787.

REMARKS. As no complete brachial loop has been preserved with any of the specimens available, it is not possible to assign the species described here to any genus beyond a broad *sensu lato* determination. It is hoped that more material will become available for further study at some future date.

The fact that there are certain morphological features which all members of the Laqueinae have in common does not imply that there is any direct relationship between '*Laqueus*' *cockburnensis* and *Rossithyris humpensis* gen. et sp. nov., described here (p. 139) from the Upper Cretaceous, Campanian of Humps Islet, Ross Island. It is interesting to note, however, that in both species the attachment of descending branches of the loop to the median septum occurs earlier than in other members of the Laqueinae.

Superfamily **TEREBRATULACEA** Gray, 1840

Family **TEREBRATULIDAE** Gray, 1840

Genus *LIOTHYRELLA* Thomson, 1916

*Liothyrella lecta* (Guppy)

Fig. 6a-c

1866 *Terebratula lecta* Guppy : 296; pl. 19, fig. 3.

1910 *Terebratula lecta* Guppy; S. S. Buckman : pl. 2, figs 1, 2; pl. 3, fig. 1.

1910 *Terebratula vitreoides* Tate; S. S. Buckman : pl. 2, fig. 3.

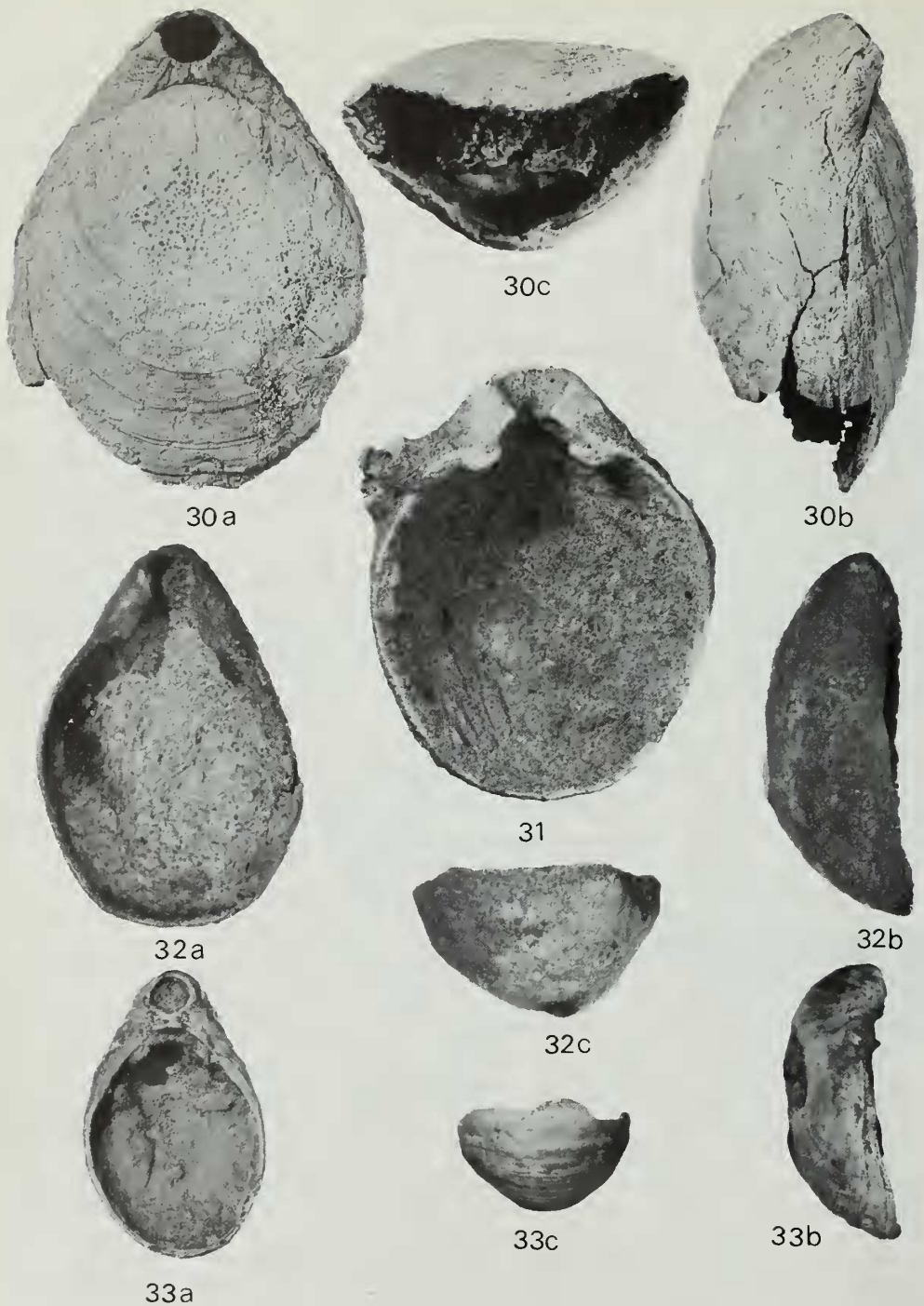
Examples of this species have been adequately described and figured by Buckman (1910) and no emendation of the original description is required.

The specimen figured here, Fig. 6a-c, is an elongate-oval terebratulide 33 mm, long, 26.3 mm wide and 12 mm in thickness. The maximum width occurs at a little over half the length of the shell anteriorly. The fine concentric growth-lines on the smooth surface of the shell are crossed by numerous faint radiating grooves. This character was included by Guppy (1866) in his original description of the species and was noted by Buckman when recording and describing the species from the Antarctic. It is thus distinct from *Terebratula vitreoides* Tenison-Woods, 1878, from the Miocene of Tasmania, which it closely resembles, and differs also from that species in its less robust appearance and less inflated brachial valve. The anterior margin of *L. lecta* is incipiently uniplicate, whereas that of *Terebratula vitreoides* is seen to develop a very faint biplication in some young and adult forms.

LOCALITIES. W. N. Croft's locs D.491.4, D.491.5, D.491.6 and D.525.3, Cockburn Island.

HORIZON. Lower Tertiary. Glauconitic Bank.

MATERIAL. Eighteen specimens and shell fragments, BB.76591, BB.76604-14, BB.76778-83.



Figs 30a-c, 31 *Magellania antarctica* (S. S. Buckman). All  $\times 1.5$ . Figs 30a-c, BB.76599, Lower Tertiary, Glauconitic Bank, Cockburn Island. Fig. 31, single pedicle valve BB.76744, Lower Tertiary of Seymour Island.

Figs 32a-c, 33a-c *Liothyrella anderssoni* sp. nov. Lower Tertiary, IPS coll. loc. 45, Seymour Island.  $\times 1$ . Figs 32a-c, Holotype.

a—Dorsal view. b—Lateral view. c—Anterior view.

*Liothyrella anderssoni* sp. nov.

Figs 32a-c, 33a-c

DESCRIPTION. Elongate-oval *Liothyrella*, averaging 48.2 mm long, 33.1 mm wide and c. 24 mm thick. Test smooth with numerous irregularly-spaced, well-defined concentric growth-lines. Massive, slightly produced, pedicle umbo dominated by a large subcircular mesothyridid labiate foramen. Delthyrium subquadrate, deltidial plates conjunct. Short, slender hinge-teeth, well developed. Anterior commissure rectimarginate.

NAME. For J. G. Andersson.

LOCALITY. IPS coll. loc. 45, c. 2 km NE of Cross Valley, Seymour Island.

HOLOTYPE. The specimen figured here, Figs 32a-c. IPS, Ohio State University, U.S.A.

HORIZON. Lower Tertiary.

MATERIAL. Three fragmentary pedicle valves.

REMARKS. This is the first record of a species of *Liothyrella* from the Tertiary of Seymour Island. The species occurs in the top beds of the La Meseta Formation (unit IV of Elliot *et al.* 1975) and cannot be directly related to any known species of *Liothyrella* previously described. It is a robust biconvex form with a massive umbo and labiate foramen, which somewhat resembles *L. oamarutica* (Boehm, 1904) from the Miocene of Kakanui, North Olap, New Zealand, in its general morphology. It differs from that species, however, in its more elongate-oval outline or narrower development of the anterior part of the shell. The marked pedicle collar seen in *L. oamarutica* is absent in *L. anderssoni*, but the arrangement of the concentric growth-lines on the shell surface and the degree of convexity of the pedicle valve is reminiscent of that species.

In addition to the above systematic descriptions, a biplicate terebratulide of Campanian age is figured here, Fig. 13a-c. The locality is given as Lachman Crags South, James Ross Island, given in Croft's notes as D.422.2. Approximately 50 specimens said to be from the same locality can be definitely assigned to the genus *Bouchardia*. The occurrence of these specimens in beds of presumably Upper Cretaceous age leaves an element of doubt regarding the accuracy of the locality citation.

Without knowledge of the internal structures of this form, it is impossible to give any more than an arbitrary suggestion as to its generic status. It has external morphological features similar to those of a *Concinnithyris* sp. from the Middle to Upper Cretaceous of the northern hemisphere.

### Conclusions

Buckman (1910 : 34) drew up a table dividing the Tertiary faunas of both Seymour Island and Cockburn Island into three main groups, as follows.

a. The Pleistocene, represented by the Pecten Conglomerate of Cockburn Island and containing a distinct fauna of *Hemithyris antarctica*, *Magasella australis* and *Magellania fontainei*.

b. Pliocene-Miocene of Seymour Island in which his *Bouchardia antarctica* and the varieties *B. ovalis*, *B. angusta*, *B. elliptica* and *B. attenuata* were dominant and *Lingula antarctica* was comparatively rare.

c. Miocene-Oligocene, represented by the Glauconitic Bank of Cockburn Island, containing *Hemithyris australis*, *H. imbricata*, *H. plicigera*, *H. squamosa*, *Magasella antarctica*, *Pachymagas antarcticus*, *Terebratula trinitatensis*, *T. bulbosa*, *T. lecta*, *T. vitrioides*, *Terebratulina lenticularis* and *T. oamarutica*.

As far as can be ascertained, there is no palaeontological evidence for the age determination of these deposits except by comparison with similar brachiopod faunas from Tertiary deposits in South America and Australasia. Buckman's descriptions and records of the species, however, were based upon poorly-preserved specimens, some of which had been greatly restored and reconstructed.

The fauna described here from similar localities on Seymour Island varies little in constitution from that described in Buckman's original work except for the addition of *Notosaria seymourensis* sp. nov., a first record for that rhynchonellide genus from as far south as Antarctica, *Terebratella crofti* sp. nov., *Magellania antarctica*, previously described and recorded only from the Glauconitic Bank, Cockburn Island as *Pachymagas antarcticus*, and *Liothyrella anderssoni* sp. nov., a new record for the genus from Seymour Island. By far the most important of these records is that of *Notosaria* since no species assigned to that genus has been recorded outside the Miocene or Recent seas.

There is no additional evidence, therefore, either to confirm Buckman's claims to the age of the deposits or to deny them. Zinsmeister (1977) records a new species of the gastropod genus *Struthioptera* from the Seymour Island Series and considered this, together with a reference to a member of the *Venericardia planicosta* group, sufficient evidence for a Late Eocene age for these beds, supporting Cranwell's (1959) data for the slightly earlier age of Palaeocene for the basal 80 m of the same deposits.

The recommendation by Elliot & Trautman (1979) that the term Seymour Island Series should be replaced by Seymour Island Group containing two major formations, La Meseta Formation and the Cross Valley Formation is accepted here, but in their description of the beds to the north of the island, little mention is made of the existence of brachiopod faunas contained within the 450 m type section. A broad reference to invertebrate fossils and an occasional *Lingula* appear in the text but the positions within the column of examples of *Bouchardia antarctica*, which was collected extensively, are not indicated. If, at some future date, account is taken of the relative positions of the varieties of *Bouchardia* within the column, together with data on their size differences, perhaps some useful information regarding the stratigraphical significance of the brachiopod faunas can be expected.

### Acknowledgements

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